subsequent interpolation to small intervals of argument for use in the construction of complete 10-place tables which are applicable in the various fields of pure and applied mathematics."

The author remarks that the most important tables of extended values of the exponential function in which the exponents are integers or fractions were those constructed by Schulze (1778), Bretschneider (1843), Newman (1883, 1889), Gram (1884), Glaisher (1883), and Burgess (1900). The extent of the contribution of each is indicated. There is no reference to Salomon's *Tafeln*, 1827, where the values of e^n, $e^{\cdot n}$, $e^{\cdot 0n}$, $\cdots$ $e^{\cdot 000000n}$, for $n = 1, 2, 3, \cdots 9$, may be found.

The only previous table of the reciprocal of $n!$ seems to have been the one by Glaisher,[1] in 1877, to twenty-eight figures as far as $n = 50$. Mr. Van Orstrand shows that Galisher's table is in error, by one unit, in the twenty-eighth figure of each of the numbers $n = 20, 27, 41, 50$. An elaborate table of $\log_{10} n!$ from $n = 1$ to $n = 1200$ to eighteen places[2] was given in C. F. Degen, *Tabularum Enneas*, Copenhagen, 1824.

In Table IX the values of $e^{n\pi}$ are given for the following sixty values of n: $\pm 7/6$, $\pm 13/6$, $\pm 19/6$, $\pm 5/4$, $\pm 9/4$, $\pm 13/4$, $\pm 4/3$, $\pm 7/3$, $\pm 10/3$, $\pm 3/2$, $\pm 5/2$, $\pm 7/2$, $\pm 5/3$, $\pm 8/3$, $\pm 11/3$, $\pm 7/4$, $\pm 11/4$, $\pm 15/4$, $\pm 11/6$, $\pm 17/6$, $\pm 23/6$, ± 2, ± 3, ± 4, ± 5, ± 6, ± 7, ± 8, ± 9, ± 10. Three of these, namely for n equal to $-9/4$, -4, and -9, are included in the seventeen values of $e^{n\pi}$ (or $2e^{n\pi}$) given in this MONTHLY, *1921*, 115–120. On page 11 of his introduction Mr. Van Orstrand remarks that "The value of $e^{\pi/2}$ given by Gauss is incorrect in the twenty-third and following decimals"; this error seems to have been first pointed out in this MONTHLY, *1921*, 120.

In table XIV is included (except for one error[3]) the value of e to 346 places of decimals published by J. M. Boorman, "consultative mechanician and attorney at law, Brooklyn, N. Y.," in *Mathematical Magazine*, Washington, August, 1887; it is here pointed out that Shanks's computation of e (1854) to 205 places was incorrect beginning with the 188th decimal. Mr. Van Orstrand states that Tichánek and Minks verified (1892) Boorman's value of e to 223 decimal places, giving as authority *Jahrbuch über die Fortschritte der Mathematik*, volume 23, p. 441 and volume 25, p. 736. A comparison of the numbers shows that they differ in the forty-third decimal place; at that place Boorman gives (correctly) "0" and not "6."

R. C. ARCHIBALD.

April 29, 1921.

The Copernicus of Antiquity (*Aristarchus of Samos*). By T. L. HEATH. (Pioneers of Progress, Men of Science.) London, Society for Promoting Christian Knowledge, 1920. 4 + 59 pages. Price 2 shillings.

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[1] *Cambridge Philosophical Society Transactions*, vol. 13, pp. 246–247.

[2] De Morgan gave a six-place abridgment in his article on "Theory of Probabilities" in *Encyclopedia Metropolitana*, 1837.

[3] Mr. Van Orstrand gives "0" instead of "6" in the thirty-second decimal place. This error may be verified by the computations of Shanks (*l.c.*) and of Glaisher (*l.c.*).

First three paragraphs: "The title-page of this book necessarily bears the name of one man; but the reader will find in its pages the story, or part of the story, of many other Pioneers of Progress. The crowning achievement of anticipating the hypothesis of Copernicus belongs to Aristarchus of Samos alone; but to see it in its proper setting it is necessary to have followed in the footsteps of the earlier pioneers who, by one bold speculation after another, brought the solution of the problem nearer, though no one before Aristarchus actually hit upon the truth. This is why the writer has thought it useful to prefix to his account of Aristarchus a short sketch of the history of the development of astronomy in Greece down to Aristarchus's time, which is indeed the most fascinating portion of the story of Greek astronomy.

"The extraordinary advance in astronomy made by the Greeks in a period of little more than three centuries is a worthy parallel to the rapid development, in their hands, of pure geometry, which, created by them as a theoretical science about the same time, had by the time of Aristarchus covered the ground of the Elements (including solid geometry and the geometry of the sphere), had established the main properties of the three conic sections, had solved problems which were beyond the geometry of the straight line and circle, and finally, before the end of the third century B.C., had been carried to its highest perfection by the genius of Archimedes, who measured the areas of curves and the surfaces and volumes of curved surfaces by geometrical methods practically anticipating the integral calculus.

"To understand how all this was possible we have to remember that the Greeks, pre-eminently among all the nations of the world, possessed just those gifts which are essential to the initiation and development of philosophy and science. They had in the first place a remarkable power of accurate observation; and to this were added clearness of intellect to see things as they are, a passionate love of knowledge for its own sake, and a genius for speculation which stands unrivalled to this day. Nothing that is perceptible to the senses seems to have escaped them; and when the apparent facts had been accurately ascertained, they wanted to know the *why* and the *wherefore*, never resting satisfied until they had given a rational explanation, or what seemed to them to be such, of the phenomena observed. Observation or experiment and theory went hand in hand. So it was that they developed such subjects as medicine and astronomy. In astronomy their guiding principle was, in their own expressive words, to 'save the phenomena.' This meant that, as more and more facts became known, their theories were continually revised to fit them."

Contents—Part I, *Greek Astronomy to Aristarchus*, 1–37: Thales; Anaximander; Anaximenes; Pythagoras; Parmenides; Anaxagoras; Empedocles; The Pythagoreans; Œnopides of Chios; Plato; Eudoxus, Callippus, Aristotle; Heraclides of Pontus. Part II, *Aristarchus of Samos*, 38–56: The heliocentric hypothesis; On the apparent diameter of the sun; On the sizes and distances of the sun and moon; On the year and 'great year'; Later improvements on Aristarchus's figures. Bibliography, 57–58. Chronology, 59.

Problems and Solutions. Associateship Examinations, Parts I and II, 1915–1919. New York, Actuarial Society of America, 1921. 8vo. 133 pages + 46 figures. Price $2.00.

Foreword: "The problems herein set forth with their solutions comprise all of the problems set in the years 1915 to 1919 inclusive, in Parts I and II of the examinations for admission to Associateship in the Actuarial Society of America. These problems and solutions are published primarily for the use of students preparing for these particular examinations; but they will unquestionably be of value to many who are teaching or studying mathematics in high school or college.

"Prior to 1920 these two examinations comprised what was known as *Section A* of the Associateship examination. The nomenclature has been changed so that they are now known simply as Part I and Part II of the Associateship examination.

"In many instances the solutions as set forth are not the only solutions of the given questions and it is not our intention to infer that the published solutions would have been more acceptable than any others to the Examination Committee of the Society. We have simply attempted to present a correct solution to each problem. The major part of the work of editing and arranging the solutions for publication was done by Dr. Lester R. Ford of The Rice Institute, working in coöperation with the Educational Committee [J. M. Laird, J. F. Little, E. W. Marshall, H. N. Stephenson, and M. A. Linton, chairman] of the Actuarial Society, under whose supervision the book has been published. Charles M. Taylor, a student of the Society, rendered valuable service in reading the proof and making helpful suggestions."